CATALOGUE

Local Sustainable Solutions - Tanzania

Collection of Successful Cases of Sustainable Energy and Climate Solutions in Tanzania

Cooking and Cooking Fuels




Light, Electricity and Water




Growing Food and Transport




Solor Heat and Others




SUSTAINABLE ENERGY SERVICES ORGANIZATION
TaTEDO
TaTEDO - SESO

INFORSE East AFRICA
International Network for Sustainable Energy

INFORSE
International Network for Sustainable Energy

With support from
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Catalogue: Local Sustainable Solutions in Tanzania

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To obtain copies of this publication, please contact the TaTEDO-Sustainable Energy Services Organization (TaTEDO-SESO) / INFORSE-East Africa coordinator in Tanzania

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Abbreviations and Acronyms

CBOs	Community Based Organizations
CO2	Carbon dioxide
CSOs	Civil Society Organisations
EASE & CA Project	East African Civil Society for Sustainable Energy and Climate Action Project
INFORSE	International Network for Sustainable Energy
JEEP	Joint Environment and Energy Project
KIDT	Kilimanjaro Industrial Development Trust
kWh	kiloWatt hour
MW	Mega Watt
NDCs	Nationally Determined Contributions to the Paris Agreement of UNFCCC
NFRE	Nordic Folkecenter for Renewable Energy
NGOs	Non-Governmental Organisations
SDGs	Sustainable Development Goals
SE4All	Sustainable Energy For All Initiative
SusWatch Kenya	Sustainable Environmental Development Watch
TaTEDO-SESO	Sustaible Energy Services Organization
TSh	Tanzania Shilling
UCSD	Uganda Coalition for Sustainable Development
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar

Foreword

The world is facing growing climate crises, harmful energy-resource profiteering, and catastrophic losses of key species critical to ecosystems at various scales. Heavy reliance on unsustainable energy sources and practices have led to ecosystem distortion and negative health impacts.

Total primary energy supply in Tanzania is dominated by biomass and has almost doubled in the last decade, making up close to 90% of the total primary energy consumption. 63.5% of the households use firewood as the main source of cooking energy, and 26.2% use charcoal. The remaining share comprises of 5.1% liquefied petroleum gas (LPG) and 3% electricity, while 2.2% use alternative energy sources. Biomass is produced and used in inefficient technologies contributing to deforestation and health challenges that affect the wellbeing of populations. The annual deforestation rate is approximately 460,000 ha/year.

Electricity is mainly generated from hydropower, oil and more recently natural gas. Total installed capacity by 2019 was 1565.72MW, consisting of hydro 573.70MW, natural gas 892.72MW, liquid fuel 88.80MW and biomass 10.50MW. It is estimated that 78.4% of the total population have access to the grid electricity while households connected are 37.7% with 73.2% of urban and 24.5% of rural areas electrified. The households electrified by solar photovoltaic technology are estimated at 30.4%. Costly fuel oil sources account for around one-fifth of power generation and are mainly required for off-grid applications and emergency on-grid power supply. Electrical supply varies in times of drought and is highly dependent on hydropower generation, leading to rolling blackouts. The unreliability of power supply has had a negative impact on the development of Tanzanian industry.

Although Tanzania has excellent wind, solar, geothermal and biomass resources for power production. The country's abundant renewable energy potential offers the possibility to overcome some of the challenges faced by the energy and power sector in a cost-effective way. This would lead Tanzania towards economic growth that is sustainable. However, this potential has not been fully exploited. Tapping more of these sustainable resources would facilitate Tanzania's ecological and socio-economic transformation, and therefore accelerating country initiative to achieve her development vision 2025. Countries with higher shares of renewables in their total energy consumption enjoy a greater level of energy independence and security.

Out of the above environmental and socio-economic concerns, the present document, is an extract of a catalogue on local Sustainable Solutions in Tanzania compiled by the International Network for Sustainable Energy (INFORSE) Network through Project's Partners include TaTEDO-SESO in Tanzania, under the Project entitled "East African Civil Society for Sustainable Energy & Climate Action" (EASE & CA, 2019 – 2022). This Catalogue is a

result of a collective hands-on documentation process portraying some of the most successful local solutions in Tanzania. Years of collaborative efforts have produced practical and proven solutions that can improve country energy supplies, contribute to reducing carbon emissions, and effectively build community resilience to climate change in Tanzania. bI hope that you will find in this catalogue the knowledge, perspective and inspiration to help and support you in your initiatives to make sustainable energy the backbone of our socio economic development efforts.

Eng. Estomih Sawe
CEO, TaTEDO-Sustainable Energy Services Organization

Acknowledgments

TaTEDO-SESO would like to thank all national CSOs, CBOs, groups and individuals in Tanzania as well as, government agencies and intergovernmental institutions that in one way or the other provided information that has been included in the Catalogue of Local Sustainable Solutions- one of the first of its kind in Tanzania.

We would also like to thank the International Network for Sustainable Energy (INFORSE), Nordic Folkecenter for Renewable Energy (NFRE) and Danish Ministry of Foreign Affairs for the support through Civil Society For Development (CISU) that has enabled this Catalogue of Sustainable Local Solutions to be prepared as part of the EASE & CA Project.

March 2023

Executive Summary

The purpose of this Catalogue of Local Sustainable Solutions in Tanzania is to popularize local solutions in support of sustainable energy and development, specifically, best practices solutions and proven financing models.

This Catalogue shows established examples of successful tried local solutions that can help to bring energy, water, and other essentials to people in Tanzania, in climate-friendly and (as much as possible) affordable ways. Hence, it is useful for people, who need cleaner and better energy and other needs for their life and for local development, as well as community leaders, change agents, media, development workers and planners. Some of the cases are well known solutions in some areas, while others are undocumented or may be unfamiliar. The publication is bridging the gap of knowledge.

The Catalogue includes 22 sustainable solutions in 6 categories in Tanzania. The main categories are cooking, cooking fuels, light and electricity, water, growing food, transport, solar heat and others.

The Catalogue was developed in the framework of the Civil Society for Sustainable Energy & Climate Action (EASE & CA) Project in 2019-23, which was a civil society cooperation project among members of INFORSE. This publication is an extract of the catalogue on local sustainable solutions from East Africa. The solutions are organized in subcategories, including improved cookstoves for both household and institutions as schools; biogas for cooking; solar electricity pumping water for drinking and irrigation; solar home systems and community mini grids powering light, refrigerators, mobiles phones, TV, etc.; solar food dryers for food preservation; and transportation for people and for carrying goods. Improved efficiency reduces the demand on fuels e.g. improved cookstoves need less fuel wood, efficient household equipment, LED lamps need less electricity etc.

This Catalogue of Local Sustainable Solutions in Tanzania can be accessed, as printed publication, and online from: *http://localsolutions.inforse.org/*

Introduction

This Catalogue of Local Sustainable Solutions in Tanzania has been prepared as a contribution to ensure that Tanzanian communities have a reference as to what they can do to reverse and adapt to the negative trends due to climate change. The solutions offer feasible methods of achieving improved and sustainable agriculture, food security, water-resource management, waste management, transport and upgrades of other currently unsustainable practices. It is hoped that this Catalogue will also be a valuable source of information for NGOs, governments, intergovernmental and other development agencies, as they seek to address concretely the energy poverty and associated challenges facing the rural poor and underprivileged population in the country and beyond.

The solutions presented here contribute to six UN Sustainable Development Goals, particularly SDG 13 (climate action), SDG7 (clean energy), SDG1 (poverty), SDG5 (gender), SDG 6 (water), SDG 2 (hunger, food), and implementations of Nationally Determined Contributions (NDCs) and of Long-term low Emission Development Strategies (LEDS) under the Paris Agreement, as well as national activities to implement SDG7 (clean energy), including the Sustainable Energy for All (SE4ALL) strategies.

The Catalogue consists of 22 solutions which are in 6 categories. The main categories are cooking, cooking fuels, light and electricity, water, transport, solar heat and others.

Each case provides information on what is unique about the proposed solution, how efficient it is in saving energy, the cost of the technology/solution, expected lifespan of the technology, whether maintenance is needed, type of fuel used by the technology, any limits or barriers associated with the use of technology, its availability, and skills needed to produce the solution.

As this Catalogue is available online as well as offline, it represents an opportunity for a wider section of society to have options that seek to promote sustainable energy and climate action in Tanzania. In the online version the cases are searchable by categories and by country. In this printed extract version there is a table of contents where the cases are sorted by categories.

The information in the catalogue can be used as advice and inspiration towards advanced solutions. When people adopt the solutions, this will bring long lasting positive changes to them.

Country Overview

Tanzania

The United Republic of Tanzania is an East African country bordering the Indian Ocean. To the north, its neighbors are Kenya and Uganda. According to the national census of 2022, the population of Tanzania is 61,741,12. Agriculture is considered the backbone of the economy and the main driver of economic growth, contributing over 29% of GDP.

Tanzania is endowed with renewable energy resources including solar, wind, geothermal, biomass, and tidal as well as wave energy. Most of the resources have not been fully developed yet. The estimated potential of solar energy is 670 MWp, with a global horizontal radiation of 4.5- 6 kWh per m2 per day. The wind potential is estimated to be 1,000 MW, with average speeds of 3 to 10m/s. Geothermal is nearly 5,000 MW. Potential for small hydropower is 480 MW. Biomass resource potential for power generation is estimated at above 500 MW.

Biomass provides 85% of the total energy consumption. The current unsustainable production and use of biomass fuels contribute to the degradation of the environment and pose health hazards to the livelihood of people. According to the WHO report on Indoor Air Pollution, document WHO/SDE/PHE/07.01 of 2002, more than 27,500 people die annually in Tanzania due to the inefficient use of solid biomass energy for cooking. The situation also contributes to deforestation at the rate of 372,871 hectares per year.

Despite the recognized benefits of modern-energy cooking services for health, local environment and climate change, large-scale adoption and sustained use of clean cooking solutions such as improved cook stoves, electricity, biogas, etc. are not succeeding in Tanzania. This is due to a variety of context specific barriers on both the demand- and supply sides. Financing, lack of appropriate business and delivery models, and poor enabling environment appear to be major constraints for manufacturers and suppliers of efficient cooking appliances. Lack of supportive policies, information, and awareness, alongside cultural barriers, dominate the demand side.

Description of Partners

TaTEDO - Sustainable Energy Services Organisation

Sustainable Energy Services Organization (TaTEDO-SESO) is a non governmental organization with more than 30 years of experience. It is actively involved in the development of sustainable low-carbon energy technologies and services to facilitate increased energy access for the rural and urban populations of Tanzania. The overall objective of TaTEDO-SESO is to improve peoples' livelihoods by increasing their access to sustainable energy services.

Some of the technologies promoted by TaTEDO-SESO include renewable energy mini-grids, improved wood-fuelled cook stoves, solar PV systems, solar drying technologies, sustainable charcoal value chain, briquettes from carbonized bio-waste, efficient electric cooking appliances, and e-mobility.

The organization is involved with implementation of sustainable energy projects and programmes in Tanzania. It manages and disseminates energy awareness information. TaTEDO-SESO lobbies and advocates to influence energy and environment related policies. In addition it supports sustainable- energy enterprises, conducts energy-related applied research, and develops networking and partnerships with local and international organizations. TaTEDO-SESO is the East African regional coordinator and national coordinator of INFORSE in Tanzania.

INFORSE & INFORCE East Africa

INFORSE East Africa network is a regional part of the International Network for Sustainable Energy (INFORSE), a global network of more than 175 NGOs working for sustainable energy solutions to protect the environment and to reduce poverty. The INFORSE-East Africa Regional Coordinator is TaTEDO in Tanzania. The National Coordinators are: in Kenya, Sustainable Environmental Development Watch - SusWatch Kenya, in Tanzania: TaTEDO, and in Uganda, Uganda Coalition for Sustainable Development (UCSD). INFORSE was established at the NGO Global Forum parallel to the "Earth Summit", UN Conference on Environment and Development (UNCED) at Rio de Janeiro in 1992. INFORSE has had Civil Society Consultative Status at the UN Economic and Social Commission (ECOSOC) since 1998, and at the UN Framework Convention of Climate Change (UNFCCC) since 2002. INFORSE has been active in NGO cooperating on projects with members on knowledge sharing, advocacy, and participation at UN climate negotiations, and UN sustainable development conferences. INFORSE has developed a large online database of contacts, has published collections of success cases, and has many years of experience in formulating plans and scenarios for transitions to renewable energy. The INFORSE Secretariat has been hosted by INFORSE-Europe in Denmark since 2002.

Cooking

Okoa V5 Efficient Household Firewood Stove

Advantages of this solution:

Okoa V5 is an efficient firewood stove designed for household cooking purposes. The Okoa V5 stove has thermal efficiency ranging from 50% to 60% as opposed to a three-stone fireplace with thermal efficiency ranging from 10% to 15%. Okoa V5 reduces firewood consumption by 50% and also has the ability to remove smoke from the kitchen.

Savings per day or production:

Okoa V5 reduces firewood consumption by 50% per day as compared with a three-stone fireplace. It also accommodates more than one pot at a time. Use of a V5 reduces the time required for cooking and lessens indoor air pollution.

Cost in money and in own time to construct:

Field experience shows that local masons charge between 25,000 TSh to 30,000 TSh (USD 10.75 to 13) per stove.
Okoa V5 is constructed using burnt bricks, sand, and cement, costing about 200,000 TSh (USD 86). Construction of the Okoa V5 stove takes one to two days.

Lifetime:

When mud is the material used to make the stove, its life span is estimated to be one year, increasing to two years if burnt bricks are used.

Maintenance needed:

The chamber of the chimney needs to be cleaned regularly to avoid tar clogging. The stove requires repair in case cracks emerge.

Resources needed in use:

The stove uses firewood. Okoa V5 can be constructed in different sizes. Okoa V5 can be built using local materials including, e.g., clay, anthill soil, rice husks/ grasses/pieces of sacks, and sawdust/ashes. It can also be built using burnt brick, sand, and cement. Sometimes, depending on user needs, ceramic tiles are used for finishing. Materials used for the construction of the stove need to be prepared in advance.

Problems and limits:

Requires firewood that is dry and that has been chopped into small pieces. The stove may not light well if the firewood used is not well dried. Performance of the stove might be affected if dimensions are not observed and used in construction.

Where and how can you get it or make it?

The stove is available in Tanzania, promoted by TaTEDO-SESO.

Skills needed to produce, install, maintain, use:

Construction of the Okoa V5 stove requires skilled masons. Major repair and maintenance may also require a skilled mason. Otherwise, the trained operator may clean the chimney and do minor maintenance of the stove.

How to use it:

https://www.youtube.com/watch?v=95oNeWyA7KI&feature=emb_rel_pause

Climate effect (if any):

The Okoa V5 stove contributes to reducing GHGs emissions by reducing the amount of firewood required for cooking, leading to reduced harvesting of biomass.

Why is it successful?

The Okoa V5 stove achieves efficient firewood combustion by maximizing heat transfer to the food being cooked. Hence, firewood consumption is reduced. Reduced household energy budgets for cooking lead to reduced deforestation.

How is it delivered and by whom?

Capacity-building on technical, business, and managerial issues is offered to masons. Masons are identified at the village level, then trained to construct, repair, and maintain the stove. They are also provided with the stove manual and with tools such as moulds. Trained masons provide such services to the community at a cost which is normally agreed with villagers during the introduction of the stove to the village.

Successful financial model

A market-based approach is used to disseminate the technology. TaTEDO-SESO plays a part in monitoring, especially the quality of the stoves.

What policies and strategies helped the success?

The Tanzania National Energy Policy of 2015, Tanzania SE4ALL action agenda, Tanzania Nationally Determined Contribution (NDCs), Draft Biomass Energy Strategy (BEST) and the draft energy efficiency strategy of 2018 recognize the role of improved cookstoves as one of the primary interventions to enhance energy efficiency. In addition, there have been various supports in terms of finance and technical know-how from development partners.

More info & Sources:

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House No GOB/KZD/883, P. O. Box 32794,
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E-mail: energy@tatedo.or.tz,
http://www.tatedo.or.tz

Improved Cook Stoves for Charcoal/Briquettes

Photo: KIDT

Advantages of this solution:

This solution of energy saving stove make cooking comfortable and economical as it uses little amount of briquettes fuel with provision to take out smoke through chimney.

Savings per day, production and cost:

Save energy by 60%, 1-2kg of briquettes is enough per day for a normal family. The stove save up to 50 kg of wood charcoal per day for a school.

Lifetime:

5 to 10 years without major repair.

Maintenance needed:

Occasional repair, cleaning the top after cooking and to remove ash regularly.

Resources needed:

Rice husks briquettes.

Problems and limits:

Since Energy saving stove constructed by KIDT is permanently fixed, no flexibility to move it from one place to another.

Where and how can you get it or make it?

It is available at Kilimanjaro Industry Development Trust (KIDT) Moshi- Kilimanjaro in Tanzania.

Skills needed to produce, install. Maintain and use:

Construction require skilled and well-trained artisans.

How to use it:

https://youtu.be/P0gRFVG5840

Climate effect (if any):

The stove can reduce wastage by 60% leading to reduced demand for fuelwood. The stove also use briquettes made form rice husks, which is renewable resource.

Why is it successful?

It is successfully because it is useful for household and institutional as it consumes little amount of briquettes compared to traditional stove. It also reduce cooking time and contribute to efforts to reduce deforestation.

If you can make it, a short description, typical problems, materials needed:

Briquettes should be used as directed by KIDT officials, avoid the use of large quantity that will result into unwanted high temperature.

How to make it:

https://kidt-vtc.blogspot.com

How is it delivered and by whom?

KIDT conducts training and seminars on how to use and maintaining energy saving stoves. Production of bricks and construction of stove is done by KIDT to ensure quality control.

What policies and strategies helped the success?

Global interest on overcoming deforestation. Tanzania Forest Policy 1997 and Bioenergy Strategy (BEST) 2015 which identify promotion of improved cook stove as a means to address wastage of biomass due to use of inefficient technologies.

More info & Sources:

Kilimanjaro Industrial Development Trust (KIDT), Moshi, Kilimanjaro

Photo: KIDT

Efficient Household Charcoal Stove/ SeTa mkaa (2nd generation)

Advantages of this solution:

SeTa-mkaa is an efficient charcoal-burning stove designed for household cooking purposes. The cookstoves have a thermal efficiency of 50.8 % (TIRDO, 2021), which means they can consume less fuel than traditional metal stoves. Reduction of fuel consumption contributes to a reduction of household cooking-energy budgets.

Savings per day or production:

The material used in SETA-mkaa to conserve heat is a fiber blanket. The efficiency of SETA-mkaa stove is almost twice that of an improved charcoal stove made with clay liner. It can save more than 60% of fuel which would have been required to prepare meals per day.

Cost in money and in own time to construct:

According to the SEECO company 2020 price list, the stove is sold TSh 150,000 (USD 66). Fabrication of one piece of SeTA-mkaa stove is estimated to take half a day.

Lifetime:

The durability of SeTA-mkaa ranges from five to seven years.

Maintenance needed:

May need to repair the firing chamber in case it is overheated and damaged.

Resources needed in use:

Seta mkaa can use either wood charcoal or briquettes.

Problems and limits:

Pot bottoms of less than 2.5 mm may melt with time due to high heat produced by the SeTa-mkaa stove.

Where and how can you get it or make it?

“It is available in Dar es Salam, Tanzania through SEECO Company.

Skills needed to produce, install, maintain, use:

Production of SeTA-mkaa, major repairs and maintenance requires skilled technicians.

How to use it:

https://www.facebook.com/watch/?v=521607365242679

Climate effect (if any):

SeTA mkaa stove uses less charcoal, therefore contributing to forest conservation by virtue of using fewer trees over time.

Why is it successful?

The design succeeds because of the stoves’ high efficiency due to good design for heat transfer, increased surface area for heat exchange, high efficiency of the combustion chamber for reduction of harmful emission, and reduction of heat energy loss by application of ceramic-fibre blanket to areas where heat exchange takes place.

If you can make it, a short description, typical problems, materials needed:

Some of the materials needed include thick sheet- iron and ceramic-fibre blanket. Several types of machines are required for cutting, moulding and joining different parts of the stove.

Distribution goes through company sales points, and stove sales agents located in various locations within the country.

Successful financial model

Support from a development partner has been utilized as capital for purchasing some machines, for market promotion, for awareness-raising and for training of the three technicians.

What policies and strategies helped the success?

The production and marketing of improved cookstoves is supported by sectoral policies of business, environment, forest, and SMEs. Biomass Energy Strategy and SE4All Action Agenda (Tanzania) support the use of improved cookstoves.

How is it delivered and by whom?

The business model involves production that starts at the workshop as well as marketing which is undertaken by SEECO social enterprise to ensure sales and continuous supply of quality stoves.

More info & Sources:

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Improved Charcoal Baking Oven (ICBO)

Advantages of this solution:

The Improved Charcoal Baking Oven (ICBO) is an efficient charcoal-fueled oven designed for households, institutions, and SMEs for baking bread, cakes, other foodstuffs such as nuts (groundnuts, cashew-nuts, etc.), potatoes, and bananas. The oven has the advantage of less charcoal consumption due to its ability to conserve heat. This ICBO also serves other purposes like cooking, heating, roasting, and baking.

Savings per day or production:

The oven has a thermal efficiency of 30 %. For less than half an hour, it uses only 600 grams of charcoal to bake 12 loaves of bread of 400 grams each.

Cost in money and in own time to construct:

The ICBO is available in different sizes. According to the price list of 2020, the small oven, which accommodates 8 bread of 500 grams, costs 430,000 (USD 185)The medium size, which accommodates 18 breads of 500 grams costs 550,000. (USD 236). Oven which accommodates 30 bread, 50 bread and 100 bread can be fabricated on special orders.

Local artisans take about a week to manufacture one oven

Lifetime:

The ICBO, used intensively, can last for 5 years and for more than 10 years if used minimally.

Maintenance needed:

After two years, repair of the firing chamber might be necessary for an oven which has been used intensively. Regular cleaning of the baking chamber after baking is always required.

Resources needed in use:

Charcoal or charcoal briquettes as fuel.

Problems and limits:

Compared to an electric oven, there is a need to get used to the charcoal oven in regulating temperature for perfect results.

Where and how can you get it or make it?

It is available at SEECO Company, Dar es Salaam in Tanzania. The stove can be ordered from the SEECO company.

Skills needed to produce, install, maintain, use:

Fabrication and repair of the oven requires skilled artisans. Use of the oven requires short training.

How to use it:

https://www.youtube.com watch?v=YQBfRM81fzQ

Climate effect (if any):

ICBO uses less charcoal compared to traditional ways of baking. It contributes to forest conservation, as it reduces the amount of fuelwood which would have been required for baking where normal stoves are used.

Why is it successful?

It succeeds, in part, because it is suitable for small scale-baking businesses. It can be used in areas where there is no- or unreliable electricity. The ICBO has a high potential for generating income for users while cutting energy budgets, saving time, reducing emissions, and conserving forests.

If you can make it, a short description, typical problems, materials needed:

Making it needs a skilled technician.

How is it delivered and by whom?

The business model starts with production at the workshop and marketing by SEECO Company that ensures sales and maintains a continuous supply of quality ovens. SEECO either supplies the oven to end-users or distributes to end-users through sales agents. This is followed by training on how to use and maintain the oven. The main actors are the company, transporters, sales agents, and end-users including households, institutions and SMEs.

Successful financial model

Initial capital for infrastructure development, including the workshop buildings and equipment, partly was covered by grant funds. Operational costs are recovered from revenue generated through selling of ovens.

What policies and strategies helped the success?

The Tanzania Biomass Energy Strategy (BEST) and Sustainable Energy for All (SE4All) Action Agenda support development of the biomass-energy sector on demand- and supply sides. For many years, the sector also has been receiving great support from donor communities.

More info & sources:

SEECO Company, E: bioenergy@seeco.co.tz. https://www.facebook.com/SEECOtz/ https://sescom.co.tz/seeco

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Jiko Bora

Advantages of this solution:

The Jiko Bora stove is a metal ceramic charcoal-burning stove with efficiency ranging from 35% to 44% compared favorably to traditional charcoal stoves whose efficiency ranges from 18% to 22%. The higher efficiency of the Jika Bora stove contributes to reduced charcoal consumption.

Savings per day or production:

Savings of 50 % charcoal compared to traditional metal charcoal stoves.

Cost in money and in own time to construct:

The stove is available in various sizes, ranging from 9, 10, 11, 14, 18, and 22 inches in diameter. Depending on the size of the stove, the prices of the stoves start at 15,000 and can run up to TSh 150,000 equivalent to USD 6.5 to 65.

The stoves have ceramic or clay liners enclosed with a metal body. The process to make the stove involves preparing the clay liner, partial

sun drying, hardening by firing in the kiln, making the outer metallic body, and assembling the two parts together. Normally, preparation of liner and cladding (metal part) is done by two different production sections. It is estimated that producing one stove might take about 2 hours.

Lifetime:

1-4 years, unless dropped, overloaded with charcoal, or water poured frequently.

Maintenance needed:

If the clay liner breaks while the outer metallic part is still strong, it is possible to replace new one.

Resources needed in use:

Charcoal is the material needed to fuel the stove.

Problems and limits:

There are quality-control problems due to lack of enforcement of standards. If Jiko Bora specifications are not rendered exactly in the manufacturing practices, both the users' safety and the stoves' efficiency are greatly compromised.

Where and how can you get it or make it?

Available in Tanzania, produced by SEECO social enterprise and other local entrepreneurs.

Skills needed to produce, install, maintain, use:

Production requires a skilled potter and trained sheet-metal workers. To produce Jiko Bora stoves, 3-5 days of workshop training are needed. Maintenance and use require only a short introduction.

How to use it:

https://www.facebook.com/TaTEDO/ videos/778253385604075

Climate effect (if any):

The stove's higher efficiency rating reflects engineered improvement over previous models in its more effective conversion of charcoal to heat. Its emissions of smoke and of greenhouse gases are lower than those of older types of stove. Use of Jiko Bora also reduces the amount of charcoal that would have been required for cooking in traditional stoves, thus contributing to reduced deforestation.

Why is it successful?

It is successful because it is more efficient than traditional stoves in fuel consumption, thus saving money which would have been required to purchase charcoal. Increases in the prices of charcoal and of other fuels, particularly in urban areas, also motivates buyers.

If you can make it, a short description, typical problems, materials needed:

Sheet-iron, pottery-clay soil, and insulation/ binding material (mixture of cement, vermiculate/ rice ashes and water), along with training.

How to make it (if possible):

Requires short training.

How is it delivered and by whom?

The main actors in the supply chain for Jiko Bora include suppliers of raw materials, stove producers (SEECO, Sahara, etc.), stove sales agents, and end- users. Producers normally sell Jiko to the sales agents and then end-users buy from the sales agents. It is also possible

for end-users to buy direct from the company. Sales agents are available everywhere in the country.

Successful financial model

Initial support was provided by development partners. In the past, the sector received some support from development partners, including investment capital to establish stove-production workshops, capacity-building, stove demonstrations, and awareness-raising. Development partners have also supported advocacy work and development of national strategies, guidelines, and laws.

What policies and strategies helped the success?

Charcoal Policy Study (World Bank 2009); Biomass Energy Strategy of Tanzania (2014), which has the ambitious target of reducing urban charcoal demand by 50% by 2030; and Sustainable Energy for All Action Agenda of 2015, with a goal of enabling more than 75% of the population in Tanzania to use cleaner cooking solutions by 2030. Stakeholders in the sector have also established the Clean Cooking Alliance of Tanzania (CCAT), which intends to coordinate the sector.

More info and Sources:

SEECO Company, E: bioenergy@seeco.co.tz https://www.facebook.com/SEECOtz/
https tp s:/ / w w w. f ac ebo o k.c o m/ TaTEDO / videos/778253385604075
TaTEDO, MbeziJuu, Mpakani Road, Goba, House No GOB/KZD/883,
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SeTa Improved Institutional Firewood Cookstoves (SeTA-IIFC)

Advantages of this solution:

SeTa-IIFC is an efficient firewood stove designed for institutions as well as for small and medium enterprises (SMEs) such as schools, colleges, prisons, hotels, restaurants, and any other mass- cooking places. The cookstove has a thermal efficiency of 54.82 %, which means it has the ability to reduce fuel consumption by more than 70% compared to three-stone fireplaces (TIRDO, 2020). The reduction of fuel consumption also implies that the stove contributes to a reduction of the institution's cooking-energy budgets, allowing less time to be spent in cooking and contributing to environment conservation.

Savings per day or production:

According to evidence from stove users, the SETA-IIFC has the ability to save more than 70 % of fuel. For example, Mnolela Secondary school in Lindi Region, before it started using SETA-IIFC, required about 430 pieces of firewood each day for preparation of students' meals. Switching to the SETA-IIFC dropped that amount to 57 pieces per day. It means that if trees of 16 inches' diameter at breast height (DBH) are harvested for firewood, this one institution reduces forest-harvesting from 2 trees to 0.25 trees per day.

Cost in money and in own time to construct:

The SeTA-IIFC is available in different sizes. According to the price list of 2020, the stove of 25 liters costs TSh 1,200,000 (USD 550), the 50 liters stove is TSh 1,600,000 (USD 730), a stove of 100 litres costs TSh 2,300,000 (USD 1045), and a stove of 200 liters costs TSh 3,500,000 (USD 1,600). The prices also include a stainless-steel pot. The fabrication of SeTA-IIFC stove and of its pot take about 5 days.

Lifetime:

The durability of SeTA-IIFC is more than 10 years.

How is it delivered and by whom?

SETa-IIFC is manufactured and delivered to end users by SEECO company.

Maintenance needed:

The chimney chamber needs regular cleaning to avoid accumulation of soot.

Resources needed in use:

Firewood or wood briquettes are used as fuel.

Problems and limits:

It requires a special pot, which means the pot has to be fabricated together with the stove. Bottom of the stainless steel pot has to be 3 mm thick to ensure its longevity.

Where and how can you get it or make it?

It is available at SEECO Company, Tanzania.

Skills needed to produce, install, maintain, use:

The fabrication and assembling of the stove require skilled technicians. Major repair and maintenance may also require skilled technicians.

How to use it:

https://www.youtube.com/watch?v=PHzxpHBjrqk

Climate effect (if any):

The SeTA Improved Institutional Stove contributes to forest conservation. It reduces greenhouse-gas emissions, since the amount of firewood used for cooking is reduced.

Why is it successful?

It succeeds because the stoves have high efficiency due to good design for heat transfer, increased surface area for heat exchange, high efficiency of the combustion chamber for reduction of harmful emissions, and reduction of heat-energy loss by application of ceramic fibre blanket to areas where heat exchange take place.

If you can make it, a short description, typical problems, materials needed:

It needs a skilled technician to make it.

How is it delivered and by whom?

SETa-IIFC is manufactured and delivered to end users by SEECO company.

Successful financial model

Support from development partners facilitated on-site placement of infrastructure, purchasing of some machines, marketing, awareness-raising, and training of the technicians. Income generated from sales of stoves covers the operational costs.

What policies and strategies helped the success?

The Tanzania Biomass Energy Strategy (BEST) and SE4All Action Agenda support the production, business, and utilization of efficient biomass stoves.

More info & Sources:

SEECO Company.
Email: bioenergy@seeco.co.tz https://sescom.co.tz/about-us/19-improved-and- modern-institutional-firewood-stoves-seta-is TaTEDO,
MbeziJuu, Mpakani Road, Goba,
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Efficient Fish-Frying Firewood Stove (SAFISTO)

Advantages of this solution:

SAFISTO is an efficient firewood stove designed for fish-frying purposes. Fish is a product that can spoil very fast, particularly in the tropical heat along the coastal districts. Fish-frying in Tanzania is one of the industries known to consume a significant volume of wood. Firewood is one of the main sources of energy for fish processing. The type of stoves used is an open fire which consumes a lot of firewood. SAFISTO stove has thermal efficiency ranging from 50% to 60% as opposed to a three- stone fireplace with thermal efficiency ranging from 10% to 15%. SAFISTO stove also has the ability to take smoke out from the kitchen. Furthermore, SAFISTO reduces users' risk of burns.

Savings per day or production:

SAFISTO reduces firewood consumption by 50% per day compared to three-stone fire places.

Cost in money and in own time to construct:

SAFISTO can be constructed in different sizes. It is built using burnt bricks, sand, lime, cement, and wire mesh. Local masons charge labour between 60,000 TSh to 75,000 TShs (USD 26-32) per stove. Materials for constructing a SAFISTO that is 100 centimeters wide costs about 250,000 TSh (USD 108). Construction takes about two to three days.

Lifetime:

SAFISTO can last for more than three years if properly used and maintained.

Maintenance needed:

The chimney chamber needs to be cleaned regularly to avoid tar clogging and requires occasional repair in case of cracks in the stove.

Resources needed in use:

The stove use firewood.

Problems and limits:

Requires dry firewood chopped into medium size pieces. Performance of the stove might be affected if dimensions are not observed and followed during construction.

Where and how can you get it or make it?

The stove is available in Tanzania, designed and promoted by TaTEDO-SESO.

Skills needed to produce, install, maintain, use:

Construction of SAFISTO stove requires skilled masons. Major repair and maintenance may also require skilled masons; otherwise, the trained operator may clean the chimney and do minor maintenance of the stove.

Climate effect (if any):

Contributes to reducing GHG emissions from wood sources. Reduces the amount of firewood required for fish-frying, leading to a reduced number of trees harvested for firewood demands.

Why is it successful?

SAFISTO achieves efficient firewood combustion and maximizes heat transfer to the fish-frying pan.

How is it delivered and by whom?

Main actors include TaTEDO-SESO, local trained artisans, fish processors and beach management units (BMUs). BMUs are involved in mobilizing the fish processors within their localities and in monitoring the performance of thestoves. TaTEDO-SESO is responsible for awareness-raising, stove demonstrations, and capacity-building of ToTs on construction and maintenance of the stove. Whenever new inquiries are received, the trained ToTs become responsible for providing the service.

Successful financial model

Grant and subsidies through the project were used to disseminate the SAFISTO during its introduction to the local communities.

What policies and strategies helped the success?

The role of improved cookstoves is realised in the national Energy policy of 2015, Tanzania SE4ALL action agenda, draft Biomass Energy Strategy (BEST), and the draft Energy Efficiency Strategy of 2018. Also, there has been support from various development partners.

More info / Sources:

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Fixed Dome Biogas Plant

Photo: MCHAU

Advantages of this solution:

Biogas reduces the need for directly burning solid biomass fuels like firewood and charcoal and burns cleanly without producing smoke or ash. Biogas systems help make waste products productive, leading to improved health, better sanitation, and lower impact on the environment.

Savings per day or production:

It saves money that could have been used to pay for commercial sources of energy or disposal of waste. Demand for firewood or charcoal and the workloads of women and children, are reduced by about 20% in households with biogas. Washing pots become an easier task in the absence of smoke and soot. Crop productivity improve due to use of slurry that remains after feedstock digestion.

Cost in money and in own time to construct:

A biogas system of 9 m3 costs about TSh 2.5 to 3 million (USD 1080 to 1300). One mason takes five to seven days to construct a biogas system of 9 m3.

Lifetime:

About 20 years, if well operated and managed.

Maintenance needed:

Fermentation process needs a continuous supply of feedstock and water.

Resources needed in use:

Animal dung.

Problems and limits:

Capital investment for construction of biogas system is high making it un-affordable to low-income families. The continuous supply of feed-stock and water to the biogas plant is a tedious work for the biogas owners.

Where and how can you get it or make it?

Available in Tanzania particularly in livestock keeper's communities such as Arusha, Kilimanjaro, etc. You can make it through local masons trained by TaTEDO-SESO, MIGESADO, CAMARTEC, etc.

Skills needed to produce, install, maintain, use:

Construction and installation of infrastructure to deliver gas needs a skilled mason and plumber, operation and maintenance needs a short training.

How to use it:

https://www.youtube.com/watch?v=XcBOy1R363c

How to maintain it:

https://www.youtube.comwatch?v=OYwUx5eOYEw

Climate effect (if any):

Biogas is a renewable source of energy and an efficient method for the conversion of biomass to energy. Renewable energies have always been identified as a prime source of clean energies that emit little or no net GHGs into the atmosphere. Biogas provides a means of mitigation to reduce the sources or enhance the sinks of greenhouse gases. One biogas installation saves an average of 8.5 tonnes of CO2 and 4,667 kg of wood per year.

Why is it successful?

Successful because it provides cleaner energy for cooking with low operation costs.

If you can make it, a short description, typical problems, materials needed:

Not relevant, needs a skilled mason to make it.

How to make it (if possible):

https://www.youtube.com/watch?v=PmBx5Zo8KZo

How is it delivered and by whom?

Through support of development partners, CSOs played major roles in awareness-raising, capacity- building of local masons, technology dissemination, and advocacy. They also facilitated linkages of masons and potential consumers. Capital investment for a good number of biogas systems constructed initially was supported by grants. Ease of availability of masons has also contributed to the success.

Successful financial model

Subsidies were applied in most of the plants constructed under development projects. The simple payback period of a biogas installation varies between 2.5 and 9.5 years, depending on whether purchased charcoal or firewood, largely collected for free, is substituted.

What policies and strategies helped the success?

Biogas was introduced in Tanzania beginning in 1975. From 2009 to 2012, the Tanzania Domestic Biogas programme, coordinated by the government entity CAMARTEC, also contributed to initial efforts. After the program ended, further development was taken over by the private sector (the trained masons) and CSOs.

More info:

Tanzania Domestic Biogas Programme, http://www.bibalex.org/Search4Dev/files/338190/171749.pdf

Photo: MCHAU

Efficient Electric Pressure Cooker

Advantages of this solution:

In Tanzania, TaTEDO-SESO in collaboration with SESCOM (which is a social enterprise) are participating in the Modern Energy Cooking Services (MECS) program, which is led by Loughborough University and financed by UK Aid. The implemented activities include awareness raising, importation of EPC and spare parts, marketing, research, advocacy and lobbying for conducive policies for EPC and other clean cooking solutions. Most of the people do not consider electricity as a cooking fuel, as they perceive it to be expensive. After discovering that cooking using electric pressure cooker is relatively cheaper than LPG, charcoal and a hot plate, the adoption rate increased sharply. The increased awareness and capacity-building have contributed to addressing the knowledge gap, which exists in Tanzania.

Savings per day or production:

The cost saving depends on the price of the electricity. In Tanzania, the EPC was approximately 7 times cheaper than kerosene, 10 times cheaper than LPG, and 13times cheaper than charcoal for boiling heavy foods, based on 2020 market prices of the electricity.

Cost in money and in own time to construct:

EPC costs about twice as much as an electric hotplate. Market prices in Tanzania range from Tsh 180,000 to 250,000 (USD 77 to 107) for quality EPCs with capacities of 4- to 6 liters, depending on the point along the market chain at which the appliance is bought by end-user.

Lifetime:

About five to six years.

Maintenance needed:

Requires replacement of rubber seal on the lid after being used for some time.

Resources needed in use:

Electricity from grid, mini-grid, and solar home systems can be used.

Problems and limits:

Use only one type of pot. Not suitable for some food like nyama choma and chapatti. Looks complicated at first.

Where and how can you get it or make it?

Most of them are imported from China, Japan, South Africa, Europe, etc., and distributed by various companies including SESCOM in Tanzania. To produce EPCs, you need investment to establish a factory.

Skills needed to produce, install, maintain, use:

EPCs are manufactured in factories and special engineering knowledge is required. Training is required to be able to provide after-sale services. Simple training/introduction is required on how to use EPCs.

How to use it:

It is good for cooking many types of food, e.g., meat, potatoes, and beans. A cookbook and several short films are available published by TaTEDO-SESO.

Climate effect (if any):

Saves forests by providing an alternative clean cooking solution. Avoids emissions from combustion of biomass. Decrease CO2 emissions, when the electricity used is from renewable sources.

Why is it successful?

A pressure cooker cooks 2-6 times faster than regular cooking as the temperature will be higher under pressure. The water starts to boil on higher temperature when the pressure is higher. The cooker is insulated, which increase the efficiency. SESCOM which is a social enterprise involved in promoting, importing, and marketing of EPCs, along with TaTEDO-SESO, which focuses on support services, i.e., research, awareness-raising, capacity-building, market development, and lobbying for conducive environments for EPCs under the support of a MECS programme financed by DFID.

Awareness and capacity-building have contributed a lot in addressing the knowledge gap which exists in Tanzania. Most of the people do not consider electricity as a cooking fuel, as they perceive it to be expensive.

After discovering that the use of EPCs is the cheapest way of cooking, the adoption rate has increased.

How is it delivered and by whom?

Main actors in the supply chain of EPCs include importer, distributors, retailers, and end-users. SESCOM imports EPCs directly from manufacturers and takes them to agents (distributors) and end- users. Some of the

consumers of SESCOM EPCs are mini-grid developers who intended to introduce efficient electric appliances to the mini-grid customers.

Successful financial model

EPCs are delivered with a pay-as-you-go financing model to the mini-grid customers, whereas customers who cannot pay the whole price at once are linked to micro-financing institutions, which arrange for them to make payments on an installment basis.

What policies and strategies helped the success?

The National Energy Policy (2015) promotes energy efficiency and alternative energy (use of biomass for cooking). Micro finance Policy (2017) creates an enabling environment for an efficient and effective microfinance sub-sector in the country that serves the needs of low-income individuals, households, and enterprises. Other supportive strategies and regulatory frameworks include SE4ALL Action Agenda (2015), Electricity Act of 2008, Rural Energy Act of 2005, and Environmental Management Act 2004.

More info and Sources:

https://data.verasol.org/products/epc/sescom9?viewall=true https://sescom.co.tz/news/24-tatedo-win-1st-for- the-2020-electric-pressure-cooker-competition https://tatedo.or.tz/attachments/article/43/Ecook%20Book%20(english).pdf

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Air fryer

Advantages of this solution:

Air fryer is a small countertop convection oven designed to stimulate deep-frying without submerging the food in oil. It is best for reheating barbequed foods, healthy food and automatically controlled, fast, safe and easy to use.

Saving per day or production:

The cost saving is high compare to normal ovens because the space heated is small compare to normal ovens.

Cost in money and in own time to construct

Market prices in Tanzania range from Tshs 150,000 (USD 164) for quality air fryer with capacity of 6 liters, depending on the point along market chain at which the appliances is bought by end users.

Lifetime:

Above five to six years.

Maintenance needed in use:

Replacement of gasket needed.

Resources needed in use:

Electricity from grid, mini grid and solar home system can be used.

Problems and limits:

Not suitable for some food eg cannot do boiling. Use only one type of pot.

Where and how can you get it or make it?

Most of them are imported from China, Japan, and South Africa etc and distributed by various companies including SESCOM in Tanzania.

Skills needed to produce, install, maintain and use:

Air fryer are manufactured in factories and special engineering knowledge is required. Training is required to be able to provide after sales services. Simple training is required on how to use air fryer.

Climate effect (if any):

Providing an alternative clean cooking solution and avoid emissions from combustion of biomass.

Why is it successful?

It is successful because it is cheaper in terms of fuel use and saves time.

How is it delivered and by whom?

Main actors in the supply chain of air fryer include importer, distributors, retailers and end users. SESCOM import air fryers directly from manufacturers and takes them to agents (distributor) and end users.

What policies and strategies helped the success?

The National Energy Policy (2015) promotes energy efficiency and alternative energy.

More information & sources:

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Cooking Fuels

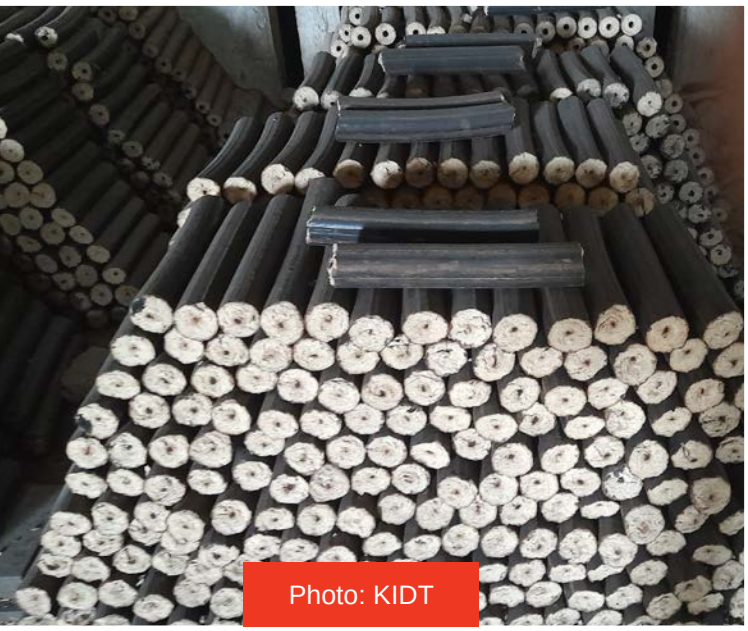

Photo: KIDT

Improved Basic Earth- Mound Kiln (IBEK)




Advantages of this solution:

The Earth Mound Kiln (EMK) is one of the oldest and most commonly used kilns in East Africa. EMK has average efficiency of 8-15%. Carbonization time is 8 days, during which the kiln requires continuous attention, and cooling time is 24-48 hour on average. The quality of charcoal produced is rather low. The Improved Basic Earth Mound Kiln (IBEK) has efficiency of more than 25%, carbonization takes only 4 days, cooling takes 24 hours, and the quality of charcoal produced is relatively high.

Savings per day or production:

IBEK has an efficiency of about 20-25%. It requires half the time required by the traditional BEK to produce charcoal. IBEK yields large pieces of charcoal with no leftovers, requires only 4.5 kg of wood per 1 kg of charcoal, and raises the calorific value of produced fuel to more than 31kJ/kg. For traditional EMK, in contrast, 7kg of wood are required to produce 1kg of low-quality charcoal of calorific value of 26kJ/kg.

Cost in money and in own time to construct:

IBEK is a temporary structure; the size of the kiln varies from a few cubic meters' capacity to over 100 cubic meters. One iron sheet to make

the chimney is required, the price ranges from TSh 15,000 to 18,000 (USD 6.50 to 7.75)

Another cost in time, effort, is labour, to construct, to load, to monitor, and to clear away the kiln. Given the reductions in number of days required for carbonization and in the amount of wood needed, the IBEK is a vast improvement over the traditional BEK in terms of labour costs.

Lifetime:

Carbonization takes four days and cooling takes 24 hours, then off-loading follows.

Maintenance needed:

During carbonization, one must monitor the process every two to three hours to ensure that the kiln is well covered throughout and that no air is getting into the kiln through its walls. Soil is used to cover any emerging openings in the structure of the kiln.

Resources needed in use:

One corrugated-iron sheet is needed to make a chimney. Wood, grasses, and soil, all locally available, complete the building materials. The IBEK requires little capital investment once one possesses the necessary common hand tools (axes, machetes, hoes, rakes, shovels, digging forks), which are usually already at hand from other daily industrial and agricultural activities of the rural population. Labour is required to form the chimney, to construct the kiln, to shepherd the process, and to unload the kiln.

Problems and limits:

More time is consumed while preparing and organizing wood in the kiln to minimize void space. A large amount of small pieces of wood is required to make the apron. More grasses are required, as the more efficient design requires the entire piles of wood to be covered completely.

Where and how can you get it or make it?

The IBEK design is applied in Tanzania's coastal and southern areas, but mainly is used in Kilosa in the Morogoro region.

Skills needed to produce, install, maintain

Arrangement of logs, chimney placement, and kiln covering requires a trained person. Monitoring of the carbonization process and charcoal off-loading need a short introduction only.

Climate effect (if any):

Each ton of charcoal produced and consumed in Tanzania using traditional methods generates nine tons of CO2 emissions; IBEK reduces emissions considerably. The IBEK is designed such that the chimney plays an important role in reducing air pollution by serving as a smoke filter. It works well, reducing the emission of harmful volatile substances into the atmosphere by as much as 75 %.

Why is it successful?

IBEK uses a relatively smaller quantity of wood, and less carbonization time (hence, less monitoring time) to produce charcoal in the same quantity as the traditional method. Moreover, the IBEK yields large pieces of charcoal with no leftovers.

If you can make it, a short description, typical problems, materials needed:

Wood is needed to make charcoal. A metal sheet and minimal metal-working skills are required to make the chimney. A large amount of earth and grass is needed to achieve full coverage of the other material input, wood.

How is it delivered and by whom?

The IBEK has been incorporated into a sustainable charcoal-production model, which involves development of a village land-use plan with land demarcation for each village's forest reserve. The village prepares a forest-

management plan and by-laws for managing the village forest reserve. The forest-management plan designates areas for sustainable charcoal production equal to 10% of the village's total forest land. A Village Natural Resource Committee (VNRC) is established to oversee and to manage the village forest land. One of the tasks of the VNRC is to approve requests from charcoal producers and to ensure that they follow sustainable charcoal production methods, including use of IBEKs rather than traditional BEKs.

Successful financial model

This model facilitates transformation of forest that, earlier, was regarded as general land, into village land. Thus, the model gives villagers the right to own, and to benefit from fees and royalties from, forest adjacent to them. Money previously collected by the central government remains in the village.

The decision on how the revenue accrued will be used is made by the village assembly. In most cases, villagers use the money for community- development projects and for forest management costs, such as patrols.

What policies helped the success?

The Tanzania National Forest Policy advocates for Community Based Forest Management and benefit-sharing. Charcoal regulations and village by-laws support these improvements.

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Coconut Husks and Charcoal Dust Briquettes

Advantages of this solution:

In Tanzania, after the edible portions of the coconut fruit are consumed, the husks often are thrown away or burnt. Improper disposal and burning of husks creates environmental problems such as air pollution and chocked (gutter) mosquito-breeding sites that support transmission of mosquito- borne cholera, malaria, and fever.

Savings per day or production:

The wholesale price of a bag of charcoal weighing between 50- 75 kg runs to TSh 45,000 - 70,000 (USD 19.50 - 30). Thus, one kilogram of charcoal costs about 900Tsh (USD 0.4), whereas one kilogram of briquettes is sold at TSh 600-700 (USD 0.25-0.30). Briquettes are more affordable than wood charcoal. Their greater efficiency stems from their higher calorific value, longer burning time, and more even heating.

Cost in money and in own time to construct:

To produce one ton of briquettes, SEECO incurs a total cost of TSh 305,104 (USD 130). These costs include materials, labour, transportation of materials, and overhead costs. To produce 1-1.5 ton, 6-8 hours are required.

Maintenance needed:

Regular maintenance of the briquette-making machines is required, including replacement of bearings, etc.

Resources needed in use:

An improved cookstove is required to use the briquettes for cooking. There is no need for a specific model of stove, since the briquettes burn well in normal charcoal-burning improved stoves.

Problems and limits:

Low community awareness of the potential benefits of briquettes limits its use, especially in households. Another challenge might be limited availability or increased costs of feedstock at a future peak of briquette markets.

Where and how can you get it or make it?

It is available in Tanzania markets and is produced by SEECO social enterprise. Some training, investment in machines, and construction of carbonization kilns is required to be able to produce briquettes.

Skills needed to produce, install, maintain, use:

Simple training is required to be able to produce briquettes. Proper ratios must be used to mix materials required for briquette production. Some training is required on how to use the briquette-production machines.

Climate effect (if any):

Methane is a greenhouse gas which is mostly emitted from decomposing waste. It has more than twenty times the potency of carbon dioxide and is ranked as a dangerous contributor to climate change. Using coconut husks and charcoal dust to produce briquettes avoids the production of some methane while producing clean fuels which are useful for cooking. Carbonization of coconut husks is undertaken in simple retort kilns through pyrolysis-process gas, thus less biomass is used to initiate carbonization before the process becomes self-sustaining.

Why is it successful?

Briquettes are more affordable than most existing fuels. They are more efficient, since they have a higher calorific value, and long burning time. They are user-friendly, clean, and smokeless.

If you can make it, a short description, typical problems, materials needed:

Required materials include coconut husks, charcoal dust, and a binder of cassava flour. After binding into shape, it requires sun and ground space to dry.

How is it delivered and by whom?

Main actors include wood-charcoal wholesalers and retailers, coconut-oil producers, cassava-flour dealers, SEECO social enterprise, transporters, and end-users.

SEECO always works to maintain the high quality of its briquettes. The enterprise uses a business approach to deliver briquettes to targeted end-users. SEECO uses marketing personnel to identify and to sell to potential customers, who are provided with product samples to test. The majority of people who have tested SEECO briquettes come back to buy more. In an average week, SEECO sells about one ton of briquettes to existing customers.

Successful financial model

Initial investment capital was covered by a grant from a development programme. SEECO covers operational and maintenance costs through business returns.

What policies and strategies helped the success?

The National Energy Policy of 2015 promotes fuel alternatives to replace wood charcoal; the Draft Biomass Energy Strategy (BEST) identified briquettes from waste as one promising alternative cooking fuel. Support come as well from the former Minister of Environment of Tanzania, Mr. January Makamba, who organized awards for competitions of the briquette producers.

More info & Sources:

SEECO, Tanzania. https://sescom.co.tz/seeco
https://www.facebook.com/SEECOtz/

KIDT Rice Husks Charcoal Briquettes

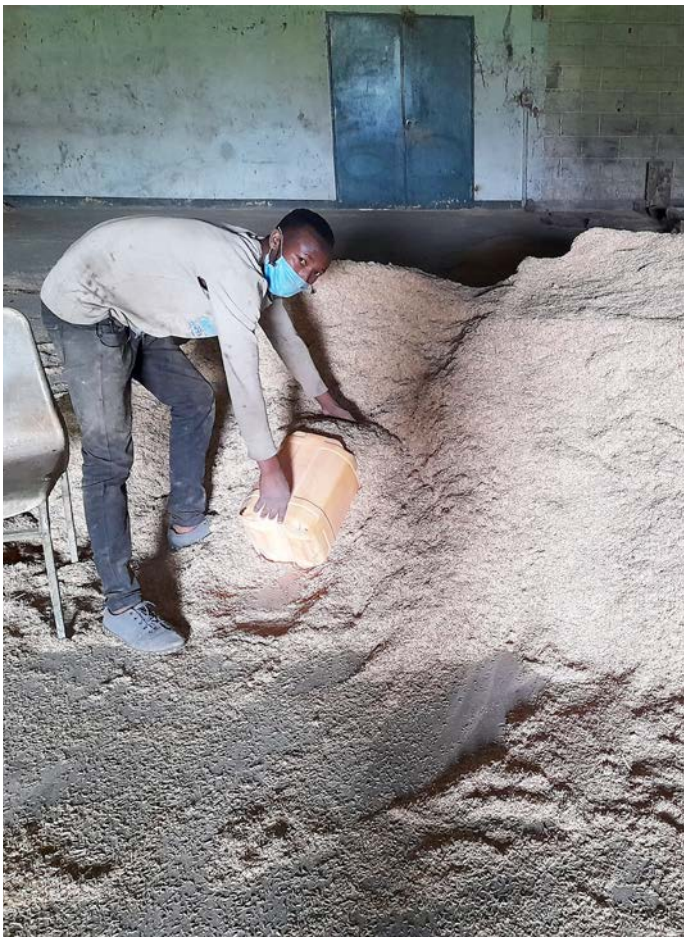


Photo: KIDT

Advantages of this solution:

Rice husks charcoal briquettes is an alternative to wood charcoal as it provides energy for cooking in households, learning institutions, hospital, for cooking various kinds of foods such as beans, Ugali rice etc.

Saving per day or production:

2kg of rice husk briquettes charcoal worth 600 Tshs is enough for cooking one day meals for a household whereas if wood charcoal is used, Tshs 1000 will be require to accomplish the task. For institution, they can consume 30kg of rice husks briquettes per day instead of 70 kg of wood charcoal.

Lifetime:

Not specified.

Maintenance needed in use:

All measures should be in place to ensure briquettes is not exposed to water.

Resources needed in use:

Rice husks are raw material for producing the briquettes.

Problems and limits:

Since availability of rice Husks is seasonal, it requires capital for purchasing and area for storage.

Where and how can you get it or make it?

It is available at Kilimanjaro Industry Development Trust (KIDT) Moshi- Kilimanjaro in Tanzania.

Skills needed to produce, install, maintain and use:

Skills for producing rice husks briquettes charcoal available at KIDT. Short training and machines are required to be able to produce KIDT briquettes.

How to use it:

https://youtu.be/yhvvWwU72bc
https://youtu.be/svbpv06B8FU

How to make it:

https://youtu.be/OrvNS51wae0

Climate effect (if any):

KIDT briquettes reducing the growing demand for wood charcoal therefore contributing to reduced deforestation. Briquettes are made out of rice husks which if not used would have rot leading to generate methane contributing to greenhouse gas emissions.

Where it is used and how many users are there:

It is used in Northern part of Tanzania especially in households, institutions and business entities. The number of users is more than 1000.

Why is it successful?

It is successful because it is cheaper and last longer.

Successful financial model and business model (s):

Development partners supported initial investment, operation and maintenances is undertaken by KIDT through briquettes sales. Production and marketing is done by KIDT who ensures sufficient supply of high-quality briquettes is maintained. KIDT provides training to end user on proper use of briquettes.

What policies and strategies helped the success?

Donor's community such as JICA -Japan has been supporting this project with the aim to limit deforestation and the effects of climate change.

More information & sources:

Kilimanjaro Industrial Development Trust (KIDT), Moshi, Kilimanjaro

www.kidt.org, njaujean@mail.co.tz
Fhttps://openjicareport.jica.go.jp/pdf/1000031330.pdf

Photo: KIDT

Light, Electricity

Kibindu Gasifier and Solar Hybrid Mini-Grid

Advantages of this solution:

Rural electrification is a critical challenge in developing countries, and Tanzania is no exception. Kibindu Village is located in the Chalinze District of the Coast Region and has a population of about 10,000 people. Up to and including the year 2015, diesel generators were the main sources of electricity for the villagers.

The solution provided is to facilitate generation of electricity through a hybrid mini-grid system and to develop a distribution network. Kibindu mini-grid is a hybrid system of biomass gasifier system (20kW/32KVa) and solar PV (20kW). The gasifier uses maize cobs as a feedstock to generate electricity. The village has the potential to supply 40 tonnes of maize cobs per season. The Kibindu mini-grid can supply electricity to more than 200 households, SMEs, and institutions. Kibindu mini-grid is a renewable energy-based system supplying reliable and clean electricity to villagers who previously had to rely on wicked lamps, candles, and diesel generators for lighting and for productive activities.

Savings per day or production:

Customers receiving their power from the mini-grid realize significant savings in comparison to the costs to them for diesel generators, formerly their only major power source. Savings of time and money have also been realized by local government officials at village and ward offices, as they are no longer traveling to town for stationery and printing services. Social services have improved, and time frames for executing business services have been shortened.

Cost in money and in own time to construct:

Installation of the two systems (gasifier and solar) and the distribution network (grid) cost about USD 200,000.

Lifetime:

About 15 to 20 years for the solar panel and the gasifier; three to four years for solar batteries.

Maintenance needed:

For the gasifier, maintenance of the combustion engine is needed in case tar accumulates. For the solar part, maintenance requirements are relatively easy; even more so for the batteries.

Resources needed in use:

Biomass, in this case maize cobs; and solar energy.

Problems and limits:

With biomass gasifiers, too much particulate matter, tar, or other residues decreases the lifetime of the combustion engine and makes frequent maintenance necessary.

The main strategy to address this challenge is to equip gasifier systems with a gas filter. This raises the costs, requires frequent cleaning of the filter system, and often produces much carcinogenic waste, especially in the case of wet stripping of the gas. Sometimes obtaining gasifier feedstock is a challenge.

Where and how can you get it or make it?

This system is installed in Kibindu village, Chalinze District, Coast Region in Tanzania.

Skills needed to produce, install, maintain, use:

Skilled technicians are required for installation, maintenance, and operation of the gasifier as well as of the solar hybrid mini-grid system.

How to use it:

https://www.youtube.com/watch?v=IsHP45imXj0

How to maintain it:

https://www.youtube.com/watch?v=WLV-FgxRx4g

Climate effect (if any):

Electricity generated from the hybrid mini-grid in Kibindu has reduced the use of fossil fuels and thereby has helped to lower the village's CO2 emissions. Emissions that would have resulted from decomposition of maize cobs are avoided through conversion of waste to energy. Solar power is renewable energy.

Why is it successful?

The rate of rural electrification is still low in

the country (only about 17%). Demand for sustainable energy for both domestic and business purposes is growing rapidly.

How to make it (if possible):

https://www.youtube.com/watch?v=lHuD5rOiv_M

How is it delivered and by whom?

Actors: SESCOM company, Husk Power Company of Tanzania (developers), USAID development partner/donor, Kibindu villages (customer/users), REA, EWURA, Ministry of Energy, District and village authority. Part of the installation costs were covered by USADF Power Africa Grant. The system is managed by SESCOM and Husk Power; maintenance and operational costs are charged in customer bills through a pay-as-you-go system.

Successful financial model

Grant funds covered capital costs. Operational costs are recovered from payment of electricity bills.

What policies and strategies helped the success?

The first and second generation Small Power Producers (SPP) Frameworks developed by the government of Tanzania, 2008 and 2015.

More info:

Read more: http://www.tatedo.org/medias/news- articles/43-kibindu and https://www.retc.co.tz/post/Industrial-Visits-for- September-2019

Sources:

TaTEDO, MbeziJuu, Mpakani Road, Goba, House No GOB/KZD/883
P. O. Box 32794, Dar es Salaam, Tanzania.
Tel: +255 738-201498,
E-mail: energy@tatedo. or.
tz, http://www.tatedo.or.tz

Mpale Solar Micro Grid

Advantages of this solution:

Access to affordable and reliable electricity is vital for Tanzania's attainment of its socio-economic goals. This is specifically difficult in Tanzania's northeastern village of Mpale in Korogwe District, where the mountainous terrain poses a technical challenge in deploying grid lines. In the village, kerosene has been the main fuel source for lighting, while biomass has been used as the main energy source for cooking. Limited access to reliable electricity has been a barrier to social and economic development activities in Mpale. Ensol developed a 50 kW solar micro grid in Mpale village, nearly 50 years after village was established.

Savings per day or production:

There is notable cost saving for customers who are using energy-efficient appliances in comparison to the prices that they used to pay for diesel generators, which were supplying power for a limited period of time. Time and money savings have also been realized by local government officials at village and ward offices, where they are no longer traveling to town for stationary and printing services. Instead, these activities are done at the village, as some entrepreneurs have started providing printing and photocopying services.

Cost in money and in own time to construct:

The microgrid system cost about USD 558,776.

Lifetime:

About 15 to 20 years for solar panels and 3-4 years for solar batteries.

Maintenance needed:

Regularly remove dust from the panel, as dust reduces the amount of sunlight that is able to reach the modules. Ensure that the charge levels in the lead acid batteries never fall below 50%. Over- discharging will significantly shorten the life of the batteries, and could potentially cause the system to fail if they cannot be replaced.

Resources needed in use:

Solar radiation

Problems and limits:

Construction delays due to the topography and remoteness of the village, poor supporting infrastructure and weather.

Where and how can you get it or make it?

The microgrid was designed and developed by

Ensol (T) Ltd, a Tanzanian company located in Dar es Salaam.

Skills needed to produce, install. maintenance, use:

Skilled technicians are required for installation, maintenance, and operation of the solar microgrid.

How to use it:

https://www.uncdf.org/article/6076/mpale-solar- power-mini-grid--maximizing-household-incomes- with-solar-power

How to maintain it:

https://www.youtube.com/watch?v=Pd3NCphnOs0

Climate effect (if any):

Electricity generated from the Mpale microgrid avoided the use of fossil fuels and has thereby helped to reduce and avoid CO2 emissions.

Where is it used and how many users are there?

More than 206 households and 50 SMEs are connected to the microgrid in Mpale village, Korogwe district, Tanga Region, Tanzania.

Why is it successful:

The success of the project is a result of close collaboration between Local Government Authority and Community members throughout the process.

How is it delivered and by whom?

Ensol is the project developer; United Nation Capital Development Fund (UNCDF) provided capital fund to cover initial costs, technical and advisory support. Energy and Environment Partnership Programme (EEP) with Southern and Eastern Africa, United States African Development Foundation also financed the project on grant terms.

Successful financial model:

Considering the high investment costs and the lack of economies of scale to make Mpale solar micro-grid project attractive to purely commercial financiers, development partners provided development finance to subsidize catalytic development projects to prove concepts and demonstrate track record necessary for scale up.

What policies and strategies helped the success?

The first and second generation Small Power Producers (SPP) Frameworks of 2008 and 2015, respectively, developed by the government of Tanzania, the Rural Energy Agency (REA), Electricity and Water Utility Regulatory Authority (EWURA) guidelines, Environmental and Social Impact Assessment.

More info & Sources:

https://ensol.co.tz/

Kimaroroni Solar Home System

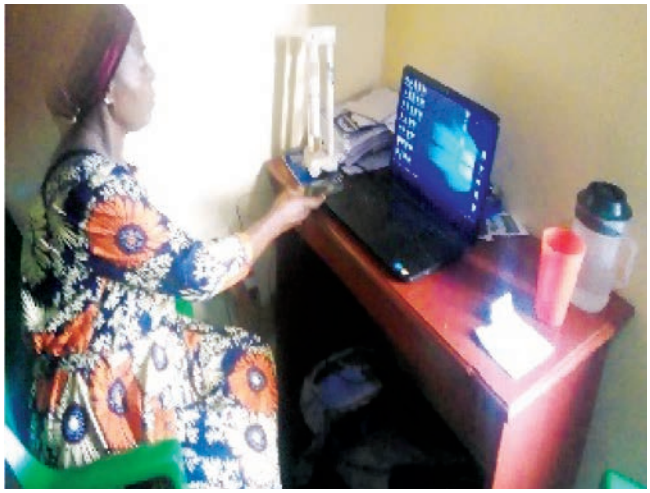


Photo: KIMARORONI

Advantages of this solution:

Kimaroroni Village Currently no Electricity Supply (Grid connected). That result to use solar system.Solar Home systems (SHS) offers cost effective mode of supplying sufficient power for lighting and appliances suitable for residential application. Sunlight is free, so will reduce household energy bills and meet a household electricity demand.

Saving per day resources:

Savings of 100% equal to 1.0Lt of kerosene per day for an ordinary family, which cost Tsh. 3000 per 1.0 Lt.

Cost in money and in own time to construct:

The solar cost TZS. 1,200,000/= (USD 515), the cost covers purchase of Battery, Inventor, Solar Panel, Electric wire ring / installation lamps accessories etc.

Lifetime:

10 -20 years but it depends on use.

Maintenance needed:

Ensure safety of solar panel, battery and inventor as well as lightning system-bulbs replacement.

Resources needed in use:

Enough Sun light energy.

Problems and limits:

Electric short in case of misuse. Unavailability of electric power once sunshine is not available.

Where and how can you get it?

The equipment purchased from solar companies and an independent technician did installation. Solar panels and accessories are available all over Tanzania.

Skills needed to produce, install, maintain and use:

Installation requires skilled person, short training required being able to do maintenance.

How to use it:

https://youtu.be/f-WXQPztdZ0

How to maintain:

https://youtu.be/Anvgg2SenaE

Climate effect (if any):

Save 100% of emission, no or negligible CO2 is released from the system.

Why is it successful?

There is enough sun light. Also high demand for electricity especially in rural area where connection is still 24.5%, use fullness of electric equipment and system due to need and guide and solar system.

Where it is used and how many users are there:

Technology are used at Kimaroroni area within Kwasadala village. The area is potential for agriculture and livestock keeping. There is no electricity and water supply. All the houses around rely on solar. There are more than 750,000 people using Solar Home System comprising households, institutions etc.

Successful financial models:

Once initial cost have been settled, there is no monthly bills/payments for its use.

If can make it, a short description, typical, problems, materials needed:

This technology requires a qualified technician to install it.

What policies and strategies helped the success?

National Energy Policy 2015 - the government has set up conducive police that allows its citizen to benefit from various sources of electricity amongst which includes solar energy.

More info & sources:

http://www.cetosudeorg.wixsite.com/cetosude

Egg Incubator

Photo: SOLOR SISTER

Why choose this solution? / Advantages of this sources:

House fix, Easy to operate, Income generating solar product and Low maintenance.

Savings per day or production:

Income generating solution.

Lifetime:

5 Years lifetime.

Maintenance needed:

Battery maintenance

Resources needed in use:

Solar powered.

Problems and limits:

Require user to have hatcher knowledge.

Where and how can you get it or make it?

Available at Solar Sister Entrepreneurs.

Climate effect (if any):

Reduces CO2 emission and it is environmental friendly.

Why is it successful?

It is affordable, clean and reliable source of light.

Sunking Home 60

Photo: SOLOR SISTER

Why choose this solution? / Advantages of this solution:

Can light up to 3 rooms, Charges up to 2 phones, Up to 24 light hours, 2 Years Warranty, It is a Solar Home System and 100 lumens.

Savings per day or production:

Can save 1200 Tsh compare to nation grid electricity.

Lifetime:

5 Years lifetime.

Maintenance needed:

Replaceable during warranty.

Resources needed in use:

Solar powered.

Problems and limits:

It is not easily affordable.

Where and how can you get it or make it?

Available at Solar Sister Entrepreneurs.

Climate effect (if any):

Reduces CO2 emission and it is environmental friendly.

Why is it successful?

It is affordable, clean and reliable source of light

Solar Heat & Others

Semi-industrial Solar Dryer

Advantages of this solution?

Solar dryers prevent destruction of agricultural produce from rain, wind, contamination, dust, insects, etc. and thereby ensure a better quality of produce. It allows small-scale farmers to improve storage conditions and reduces after-harvest losses. The higher quality increases the value of dried products, which may justify higher market prices.

Savings per day or production:

The dryer needs nothing more than solar radiation. The solar dryer can improve food security by allowing longer storage of food after drying compared to food that has not been dried.

Cost in money and in own time to construct:

The initial cost to acquire the semi-industrial solar dryer is high. The total cost of the materials amount to Tsh. 10 millions. A well-managed solar-drying business, however, can realize a payback period of 6-12 months.

Lifetime:

Depending on handling, the dryer's ultraviolet (UV) resistant plastic (Visqueen) could last for more than Solar two years before changing it. The frame could last longer, especially if treated with anti-corrosion materials.

Maintenance needed:

After some time, it requires replacement of Visqueen papers, plus anti-corrosion material for treating frames.

Resources needed in use:

Solar radiation.

Problems and limits:

Not workable at night, efficiency decreases to a large extent on cloudy days, overheating may occur if regular attention is not paid.

Where and how can you get it or make it?

It is available in Tanzania. SESCOM is involved in construction and marketing.

Skills needed to produce, install, maintenance, use: Training is needed to construct, to maintain, and to use the dryer.

Climate effect (if any):

Drying food reduces its volume; thus, the amount of fuel which would have been required for transportation is reduced. CO2 emissions decrease as well: if solar drying replaces drying by electricity or fossil fuel, it reduces CO2 emissions.

Where it is used and how many users are there?

Semi-industrial solar dryers are used in Tanzania by more than 1000 users.

Why is it successful?

It succeeds due to its potential to increase the ambient air temperature to a considerably high value for faster drying of agricultural crops.

If you can make it, a short description, typical problems, materials needed:

Some of the material needed includes galvanized sheet 2 mm, Visqueen sheet, green plastic wire mesh, square pipe, angle section, etc.

How is it delivered and by whom?

The main actors include the suppliers of construction materials, constructors such as SESCOM, a Small Industry Development Organization (SIDO), NGOs involved in awareness- raising and capacity-building such as TaTEDO-SESO, development partners with interest in supporting the initiatives, such as USAID, research institutions such as Sokoine University of Agriculture that are involved in technology improvement and research, and the Ministry of Agriculture and Cooperatives.

Successful financial model

Local capacity-building is one of the aspects that contributed to successful dissemination of semi-industrial solar dryers.

What policies and strategies helped the success?

Tanzania Horticultural Development Strategy 2012-2021, Agricultural Sector Development Strategy (ASDS), the Agricultural Sector Development Programme (ASDP).

More info:

SESCOM, Tanzania https://sescom.co.tz/ TaTEDO, Tanzania: https://www.tatedo.co.tz/

Kawanda Solar Dryer

Why to choose this solution? / Advantages of this solution:

Preservation of agricultural produce is one of the central problems faced by small-scale farmers in Tanzania. Most frequently, horticultural crops in the markets spoil; some also remain unharvested, left in the fields due to inadequate market. Poor infrastructure also increases time to get crops to markets and often results in crops being damaged. At the end of the growing season, the supply of produce diminishes until the next harvest. Solar dryers allow small-scale farmers to transform their harvests into storable, tradable goods, which they can sell off-season at higher prices.

Why to choose this solution? / Advantages of this solution:

Preservation of agricultural produce is one of the central problems faced by small-scale farmers in Tanzania. Most frequently, horticultural crops in the markets spoil; some also remain unharvested, left in the fields due to inadequate market. Poor infrastructure also increases time to get crops to markets and often results in crops being damaged. At the end of the growing season, the supply of produce diminishes until the next harvest. Solar dryers allow small-scale farmers to transform their harvests into storable, tradable goods, which they can sell off-season at higher prices.

Savings per day or production:

Avoids loss and wastage of crops, particularly of vegetables and fruits. The Kawanda solar dryer can reduce wastage of a harvest surplus,

allow storage for food shortages, and in some cases facilitate export to high-value markets.

Cost in money and in own time to construct:

Investment costs of solar dryers vary highly depending on the size of the solar dryer. Construction costs for a solar dryer of 4-12 trays range from 1.3 to 4 million Tanzanian Shillings, equivalent to US$ 565 to 1,740. The payback period for such dryers ranges from 2 to 4 years depending on the rate of utilization. Roughly two to five days are needed to construct a Kawanda solar dryer of 12 trays, using wooden materials.

Lifetime:

Usable for 8-10 years, unless 'Visqueene' polyethylene plastic is punctured with sharp edges or damaged by sun after some time.

Maintenance needed:

Replacement of "Visqueene" polyethylene plastic whenever it is damaged.

Resources needed in use:

Raw materials such as fresh vegetables, fresh fruits, etc can be dried. Materials should be well cleaned and chopped before being dried. Otherwise, it just requires full sunlight and good air circulation.

Problems and limits:

Cloudy or rainy days may slow the process somewhat due to reduced input of sunlight, unless the system is integrated with a conventional energy-based system. Many people are still unfamiliar with solar- dried products, which makes market promotion important.

Where and how can you get it or make it?

In Tanzania, TaTEDO-SESO and other stakeholders have trained more than 50 local carpenters to construct and to maintain the solar dryer as well as to use the dryer and dried products.

Skills needed to produce, install, maintain, and use:

Short training needed on how to construct and maintain the solar dryer. Users of solar dryers need a short introduction on how to use it.

How to use it:

https://www.youtube.com/watch?v=Un-1X4vu_YY

How to maintain it:

Keep shelves and enclosure clean, monitor for termites, repair torn film or broken glass.

Climate effect (if any):

The energy input needed in a solar dryer is less than what is needed for freezing or canning. Solar drying prevents food from decaying and spoiling, which would have resulted in methane release to the atmosphere.

Why is it successful?

Support services provided to entrepreneurs, including capacity-building through training and awareness, have contributed to the success. Presence of the Tanzanian Food Processors Association (TAFOPA) that has the objective to promote the development of women's entrepreneurship in the food -processing sub-sector through the improvement of existing micro- enterprises managed by women, and to encourage new ventures with a potential to grow into small and medium enterprises.

If you can make it, a short description, typical problems, materials needed:

Materials used for construction include timber/ wood, "Visqueene" polyethylene plastic, mesh-covered drying trays to hold the produce, iron sheet for construction of chimney.

How to make it (if possible):

Short training is needed on how to make it.

How is it delivered and by whom?

Main actors of the solar dryer initiative include suppliers of agricultural produce, agro-processors, sales agents, development partners, and end users. Awareness -raising, product demonstrations, and market promotion of agro-processed foods through exhibitions, radio, newsletters, and other media have been used to popularize and to create demand for solar-dried products.

Successful financial model

In most cases, grants and loans have been used to cover initial investment costs. Operational and maintenance costs are covered from income generated through sales of the solar-dried products.

What policies and strategies helped the success?

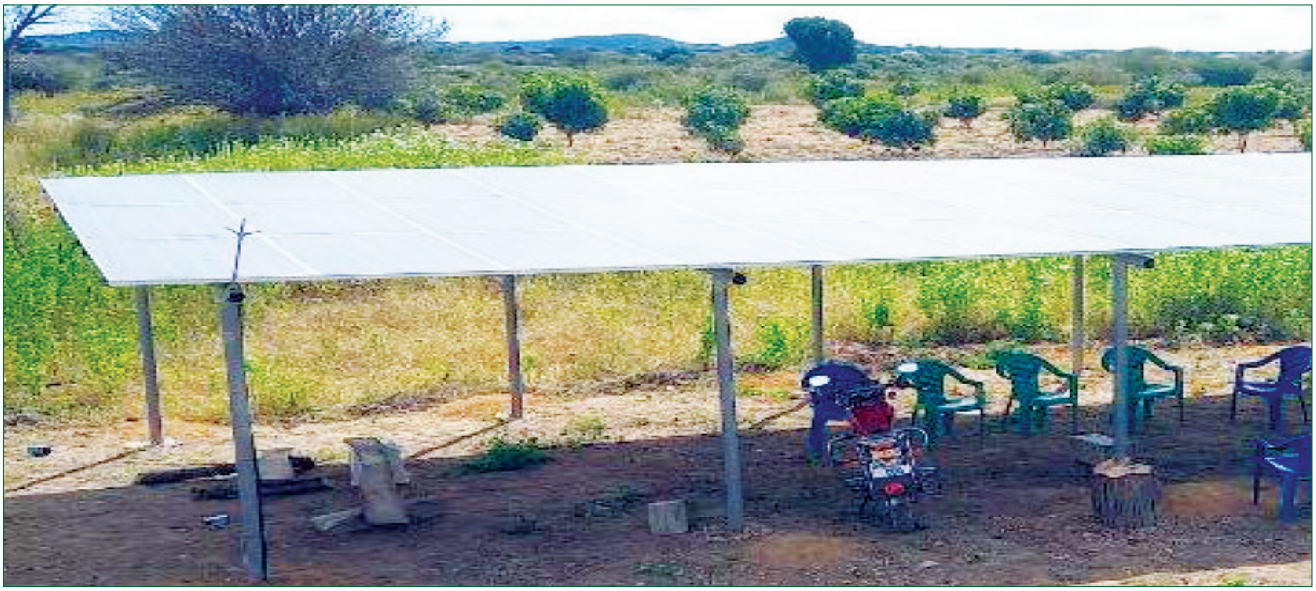
Tanzania Horticultural Development Strategy 2012- 2021, Agricultural Sector Development Strategy (ASDS), the Agricultural Sector Development Programme (ASDP).

More info & Sources:

A manual on how to use solar dryer is available at TaTEDO-SESO office, and can be accessed through request to TaTEDO. Address: MbeziJuu, Mpakani Road Goba House No GOB/KZD/883,
P. O. Box 32794, Dar es Salaam, Tanzania.
Tel: +255 738-201498,
E-mail: energy@tatedo.or.tz,
http://www.tatedo.or.tz

Water

Mpunzungulu Huzi Solar Powered Drip Irrigation Mango Scheme



Advantages of this solution:

Increases in population along with rising demands for water and energy have caused stress to water and energy resources. Replacement of conventional sources of energy with renewables, and of conventional methods of irrigation with highly efficient irrigation techniques, will increase global water and energy security as well as benefit the environment.

Mpunzungulu Agriculture Marketing Cooperative Society (AMCOs) is involved in small-scale commercial farming and processing of mangoes. The farm comprises 200 acres and is expected to expand to 500 acres. Diesel is the main source of energy used for pumping water from the borehole for irrigation of the mango farm. Replacement of the diesel pump with solar and use of drip irrigation will minimize water use while contributing to increased farm productivity and environmental conservation.

Savings per day or production:

Solar is an abundant source of energy and available for free. Drip irrigation uses less water without affecting the crop yield. A solar-powered water system is cost-effective over years, as it requires minimal operational and maintenance costs, unlike a diesel-powered system.

Cost in money and in own time to construct:

Cost involved in installation of the system to cover 20 acres amounts to TSh. 78,600 million equivalent to USD 34,000 (solar water pump with capacity of 18 m3/hour costs TSh. 48,300 million equivalent to USD 20,900 and the drip irrigation system costs TSh. 30,300 million equivalent to USD 13,100).

Lifetime:

The system is expected to last for a period of 3 to 5 years.

Maintenance needed:

Requires regular cleaning of the water pump. Drip plumbing requires at least annual testing, adjustment, and repairs of leaks.

Resources needed in use:

Solar radiation.

Problems and limits:

No solar power at night so there is a need for a large battery bank. High initial costs for material and installation and long return of investment.

Where and how can you get it or make it?

Sold by companies in Tanzania e.g. by Merry Water Company Limited https://www.merrywater.co.tz/, Ensol Tanzania Ltd, Davis & Shirtliff https://www.davisandshirtliff.com/tanzania-branches.

Skills needed to produce, install, maintain, use:

It requires special skills to manufacture solar and water pump. Simple training is all that is required to maintain and use it.

How to maintain it:

Requires regular cleaning of the water pump. Drip plumbing requires at least annual testing, adjustment, and repairs of leaks.

Climate effect (if any):

Solar power is pollution free and causes no greenhouse gases emitted after installation. It reduced dependence on foreign oil and fossil fuels. Eliminates burning of diesel fuel to power pumps; and reduces water use.

Why is it successful?

The agricultural sector is the largest employer in Tanzania, sustaining the livelihoods of more than 70% of the population. Increasing agricultural productivity is recognised as one of the most effective ways to fight poverty and to stimulate socio-economic development. Irrigation is among the measures that can improve yields and reduce vulnerability to changing rainfall patterns, and drip irrigation delivers water specifically to plants' root zones, resulting in vastly reduced water losses to evaporation, runoff, and off-target spray and overall lower use of water. Solar water pump has provided reliable, cost-effective and environmentally sustainable energy for the Mango farm.

If you can make it, a short description, typical problems, materials needed:

Equipment required includes solar panels and other accessories, water pump, special pipe for drip irrigation, small replacement parts such as emitters, etc.

How is it delivered and by whom?

Main actors include Chamwino District Council (is a government authority of the area, where the farm is located. It is responsible in provision of extension services, and assisting AMCOS to attract different investors), Mpunzungulu AMCOs (is an association of mango farmers and owners of the farm), University of Sokoine (suppliers of mango seedlings), World Resource Institute (financier of the solar powered drip irrigation system), TaTEDO-SESO (involved in installation of the system), Solar pumps companies (suppliers of solar pump and drip irrigation system).

Successful financial model

Public private Partnership and Special Purpose Vehicle.

What policies and strategies helped the success?

Tax exemption for solar panels.

More info and Sources:

Contact: Chamwino District Council, Dodoma, Tanzania. TaTEDO, MbeziJuu, Mpakani Road, Goba, House No GOB/KZD/883,
P. O. Box 32794, Dar es Salaam, Tanzania. Tel: +255 738-201498,
E-mail: energy@tatedo.or.tz,
http://www.tatedo.or.tz

Green House and Drip Irrigation Farming

Photo: ANGAZA WOMEN CENTER



Advantages of this solution:

Drip irrigation is an efficient water and nutrient delivery system for growing crops. Relatively less water and work force is required to irrigate crops. Combination of drip irrigation and greenhouse enhance water use efficiency much more. Greenhouse farming increase crop production because it is possible to create the optimal climate conditions needed for plant growth and it provides possibility to grow more plants per square meter than growing crops in an open field. It is easy to control crop pest and disease and possible to cultivate through the year. Greenhouse help to use little amount of water.

Saving per day or production:

It saves water to about 50% because the environment is enclosed and the efficiency of the drip irrigation system where water is directed to the plant root. Crop pest controlled when cultivating in green house, help little use of pesticides or no use at all. Therefore, it means less money is spent.

Lifetime:

The greenhouse can last for 15 years old and above.

Maintenance needed:

After 5 years, plastic nylon needed to be repaired.

Resources needed:

Resources needed include standard steel type, steel type assembly and connection, side insect proof screen netting, greenhouse plastic for roofing, Drip irrigation system, water supply (Tank tower, Tank and pipe network).

Problems and limits:

Temperature increasesduring dry season, leading to affect plant growth negatively. Frequentlywatering/irrigation can bring cooling of the plants.

Where and how can you get it or make it?

Available at Angaza Women Centre in Tanzania promoted by Balton Company, Greenhouse Tanzania, etc.

Skills needed to produce, install, maintain and use:

Installation and repair of greenhouse needs trained personnel. Training is needed in order to be able to construct and repair.

How to use it:

https://youtube.com/shorts/PXS5xKL30sw?feature=share

Climate effect (if any):

Greenhouse make possible to use small area to produce large amount of produces thus eliminating the need to open new field hence reduced deforestation. The use greenhouse uses little amount of water hence it is suitable during the drought condition. Also due to climate change there is an increase of crop pest, the greenhouse can help to reduce use of pesticides to control pests contributing to reduce GHG emissions.

Why is it successful?

Enable production even in off-season, normally crops produced in off-season fetch good market price. It is successful because a small area is used for installation of greenhouse. In addition, the vegetable is organically produced hence reduce the chemical consumption.

What policies and strategies helped the success?

National irrigation Master plan, Tanzania Agriculture policy 2013, Tanzania Horticultural Development Strategy 2012-2021.

More info & sources:

Angaza Women Centre (AWC),
P.O Box 143, Sanyajuu - Siha, Tanzania,
Email- angazawomen@yahoo.com,
Telephone +255 756716798.

Transport

Bicycles

Advantages of this solution:

Bicycles are used for productive activities, transporting both people and goods. Cycling is a cheap mode of transport, certainly when compared with traveling by car or by any motor vehicle. It is faster than walking and is not easily impeded by traffic jams. A large percentage of cycling also supports income-generating activities in Tanzania.

Savings per day or production

Reduction of transport-related expenses, including time requirements, benefiting households as well as small businesses that use bicycles.

Cost in money and in own time to construct

New and used bicycles are available from many shops all over the country. Depending on condition, their prices range from TSh 150,000 to 300,000. A bicycle can last for five years or more, depending on usage, handling, and maintenance by its user(s).

Lifetime:

Depending on handling and maintenance by the user and frequency of use, bicycle can last for more than 5 years.

Maintenance needed

Cleaning, lubrication, protection from the elements, and repair of small damages will keep it in working order for years. Requires some training or relevant experience, simple materials, and small tools.

Resources needed in use

Bicycles run on metabolic “human power”. New in the bicycles market are the e-bikes, which are mechanically boosted, so it can partially power the bicycle through a battery.

Problems and limits

Exposure to road accidents is high, especially in crowded and heavy traffic areas, given the lack of dedicated lanes for cyclists. Bicycles are less comfortable than vehicles.

Where and how can you get it?

Available in many regions and shops in Tanzania. Requires training or applicable experience, tools, and supplies to assemble correctly.

How to maintain it

Simple but specific training is required to use, and repair bicycles that are safe to ride. Do-It-Yourself guides for simple repairs and maintenance.

Climate effect (if any)

Transport, largely fossil-fuelled, is the third-largest source of CO2 emissions. Bicycles produce zero carbon emissions. Further, bicycles don't chew up the roads as motorized vehicles do. They are a far more sustainable technology, as it takes much less energy, along with fewer and less toxic materials, to make a bicycle than it does to manufacture any motor vehicle.

Where it is used and how many users are there

Used almost everywhere in Tanzania. Tanga, Shinyanga, and Tabora are among the leading regions with many cyclists.

Why is it successful?

Bicycles have many benefits, including pollution and CO2-emission reductions as well as ease of maneuvering and operation. Of all transport other than walking, they incur the lowest costs in maintenance. Daily or regular bicycle-riding usually has positive effects on riders' fitness. Cycling functions even with little or no upgraded infrastructure, and bicycles do not occupy large parking spaces.

How it is delivered and by whom

Supply is demand-driven. There are many suppliers, distributors, and agents all over Tanzania. MeTL Group's National Bicycle Company (NABICO) is a major manufacturer and assembler of bicycles in Tanzania. Also, there are several clubs for cyclists in the country.

Sucessful financial models

Prices of bicycles (new or used) and operational costs are affordable by the majority.

What policies and strategies support this success

Tanzania's transport policy include bicycles. Bicycles do not need a road license, there are no road penalties for cyclists, etc. In addition, bicycle shops are located throughout the country, facilitating access.

More information

https://www.poverty.ch/measuring-the-impact-of- bicycles-in-tanzania/ ~~(English~~), https://www.youtube.com/user/WorldBicycleRelief ~~(English),~~

https://onebiketz.com/ ~~(English)~~, http://www.bikeinafrica.com/ (English & French), especially "Loving Tanzania" by bike. https://www.bicycling.com/repair/

YouTube Channel for "Africa's Cycling Revolution" (English): https://www.youtube.com/c/Olympics/ search?query=africa%27s%20cycling%20revolution

Bajaj

Advantages of this solution:

Fossil fuels are the root cause of many environmental problems threatening our societies, chief among which is climate change; e-three wheelers would significantly contribute to improving air quality and reducing public health costs, If we use e-mobility as zero-emission technology, we will reduce road transport emissions to 30% below today's level. The travel costs are low, efficient and affordable for all sections of the society, In addition, e-three wheelers lower fuel and maintenance costs and ease of use compared to fossil fuels three-wheeler.

Description of the solution

Electric three wheelers/e-tuktuk (e-Bajaj) can be powered by an electric motor that draws electricity from a rechargeable storage battery and is capable of being charged from an external source through plug-in charger, battery swapping, slow and (or) faster charger from residential or public electric service. This type of solution can be used for passenger and (or) cargo purposes, and electricity is used as an alternative to diesel/petrol fuels. Currently in Tanzania available electric bajaj the market, have electric motor with power capacity range from 600W to 4000W, with 3-seats capacity for passenger bajaj.

Savings per day or production:

Electric three wheelers is less expensive for fuel and maintenance. It lowers the fuel cost by 70% (With the use of electricity). It lowers the maintenance cost due to minimal wear and tear from the propulsion system of the Electric bajaj.

Cost in money:

E-three wheeler price range from USD 4,200 to 5,000 for new electric bajaj and approximately USD 5,000 to USD 6000 for a retrofitted one. E-bajaj can cover more than 100 km per charge with an average speed of 45 to 55km/h.

Lifetime:

Depend on handling or how properly used and maintained by the user.

Maintenance needed:

Electric bajaj require less maintenance. Batteries and motors used by e-bajaj do not require routine maintenance.

Resources needed in use:
E-bajaj use electric energy from the rechargeable battery storage charged by normal supply. Charging infrastructures needed are plug-in charger (slow charger) can be used during a night in residential or during parking at public areas/service with power supply, also battery swapping stations/ faster charge stations.

Problems and limits:
Currently, for available electric bajaj are limited with high upfront cost, lack of convenient and affordable charging solutions, policies and regulations are major barriers to accelerating e-bajaj.

Where and how can you get it or make it?
E-bajaj are available in Dar es Salaam Tanzania, they are imported from China and India by TRI Company and retrofitted in Tanzania by SESCOM Company.

Skills needed to produce, install, maintenance, use:
Assembling and retrofitting of e-bajaj require skilled and experienced engineers. Major repair and maintenance may require skilled technicians otherwise trained operators may do minor maintenance.

How to use it:
Training is required, it could be through Vocational Education and Training Authority (VETA) or from any other recognized institution.

Climate effect (if any):
Contribute to reducing GHG emission from fossil fuels bajaj which emit smoke that led to the global warming effects, which has a high impact on the country and socio-economic factors such as human health, poverty, low agricultural production, etc.

Why is it successful?
Operational costs for e-bajaj are lower compared to fossil fuel powered bajaj.

How to make it (if possible):
Electric bajaj is manufactured in factories and special engineering knowledge is required.

How is it delivered and by whom?
There few innovators (who retrofit IC engine into EVs), suppliers, distributors, and agents for some city in Tanzania (example SESCOM company, E-motion Africa in Arusha, TRI company, AUTO-TRACK Company through DIT in Dar es Salaam, LINK-ALL, SINORAY Company).

Successful financial model:
Different financing mechanisms is being practiced including lease to own model.

What policies and strategies helped the success?
There are no specific policies and strategies to support e-mobility in Tanzania, it is a new area which need to be developed.

More info & Sources:
http://www.unfcc.int/news/advancing-electric-mobility-in-africa.
https://www.solutionsplus.eu/dar-es-salaam








Local Sustainable Solutions - Tanzania

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